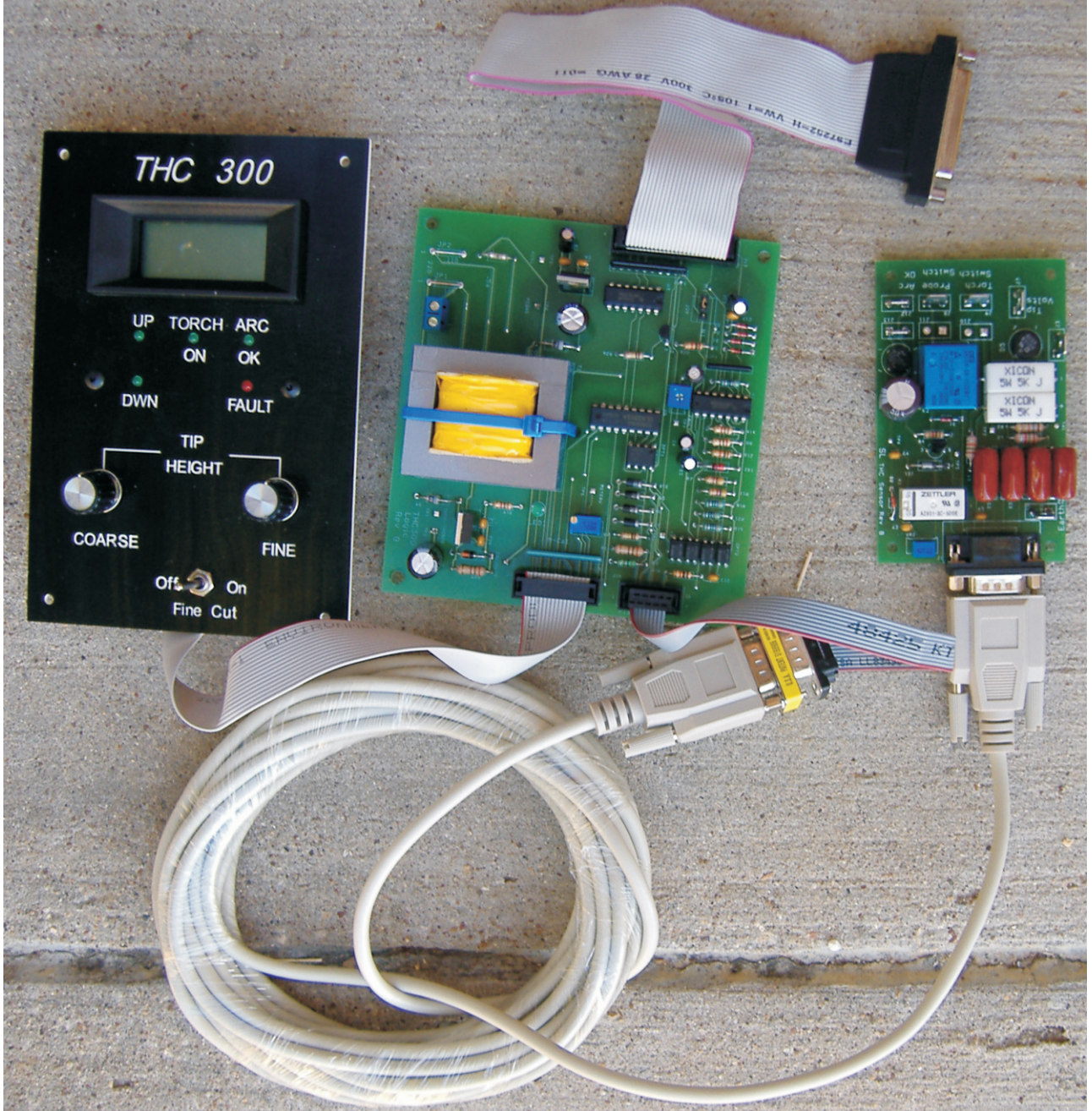# THC 300A
User Guide

Jim Cullins - Sound Logic
James_cullins@sbcglobal.net

Bob Campbell - Bob Campbell Designs
Bob@campbelldesigns.com

Acknowledgments

The **THC 300A** project was developed by **Tom Caudlet** and **Art Fenerty**. Tom developed the electronics interface and Art modified his Mach2 program. Together, they are keeping the cost of CNC Plasma software at an affordable price. The THC project already has enable some customers to produce parts that they never thought that they could.

Art Fenerty   ArtSoft Software Incorporated (**Mach3**). Art is the mind behind the fantastic Mach2 CNC control program. Art, thanks for such a great program.

Tom Caudlet Fourhills Designs. Tom is a design engineer with many years experience. Tom, thanks for the great interface and all the effort that you put into making the THC 300A project come to life.

Jim Cullins Sound Logic. Jim modified the interface that Tom developed and adapted it to the second parallel port interface. Jim is the driving force behind getting the THC 300A project to market. Thanks Jim for all the late nights and great design work. Your breakout board has been a great success and very well received in the market place. I expect that the THC board set will be equally well received in the marketplace

THC300

Torch Height Control Grounding

 Before getting into the operation of the THC I want to address an item that most in experienced users have problems with.

That item is **proper grounding**.

To Ground the table:

If you building does not have suitable grounding, locate a spot close to the table and drive a grounding rod into the ground about 4ft.

Attach a grounding strap 2.5 to 3 inch bradded grounding strap from the rod to the table keep it as short as practical.

Then, connect another one from your plasma machine to the same connection point on the table l.
Make sure the grounding connector on the sensor board is secured to the plasma grounding point (chassis).
Next make sure the shielded DB9 cable is NOT grounded to the cabinet where the computer and or LOGIC board is mounted.

The computer will be grounded through the power outlet in the building. DO NOT strap the computer cabinet to the table or the plasma machine.

The whole idea is to keep the PC and logic board ground separate from the high current plasma table ground to prevent ground loops.

Hint:
 If you have a reading on the meter before you fire the torch you more than likely have a grounding problem and it should be rectified before you continue on.

INTRODUCTION

There are a variety of torch height controls or "standoff controls" on the market. ESAB®, Thermal Dynamics® and Hypertherm® manufacture torch height controls for use with their plasma cutting equipment. Innerlogic® Inc. specializes in manufacture of THC's. Each of these automatic THC's has a variety of functions and features. But all use the same basic elements to control position of the torch relative to the material being cut. This **"torch to work"** distance or **"Torch Height"** is critical to both cut quality and parts life. If the torch is too high or too low the quality of the cut will be impaired.

The torch height control uses arc voltage (**Tip Voltage**) to maintain a consistent distance from the work surface while the torch is cutting. This allows the system to maintain proper torch height regardless of variations in the material, or flatness of the cutting bed. The open circuit voltage is around 300vdc. While cutting it will range from 80vdc to 200vdc and that depends on the operating current and cutting height . In Fine Cut mode the range is about 40vdc to 100vdc.

In Mach3, the user can set the initial Pierce height. Once the torch has pierced the work surface, motion of the cutting machine is enabled and the torch begins to move. Once cutting begins the THC monitors the tip voltage, filters it and divides it down then compares it to the referenced voltage set by the Coarse and Fine adjustments on the control panel. Then adjusts the head up or down to control the voltage and therefore the height.

Each voltage setting corresponds to a specific height that optimizes the arc characteristics for a clean, straight cut. Torch height has the greatest affect on bevel angle of the plasma cut piece. Setting the voltage too high results in more material being removed from the top of the kerf than the bottom. This causes excessive top rounding and positive bevel. Setting the voltage too low results in too much material being removed from the bottom of the work material. This causes undercutting or negative bevel

Torch height controls have many features and capabilities. But the most important is torch height control. Piercing at the right height will save you money on torch tips. Cutting at the right height will ensure good cut quality and minimize expensive rework operations. When properly used a torch height control pays for itself in a short time.

THC 300A Interface

The THC 300A consists of two PC boards and a meter board. A current transformer is also shipped with each board set. The smaller board with the DB9 connector is the **Sensor** board that is installed in your plasma control enclosure.
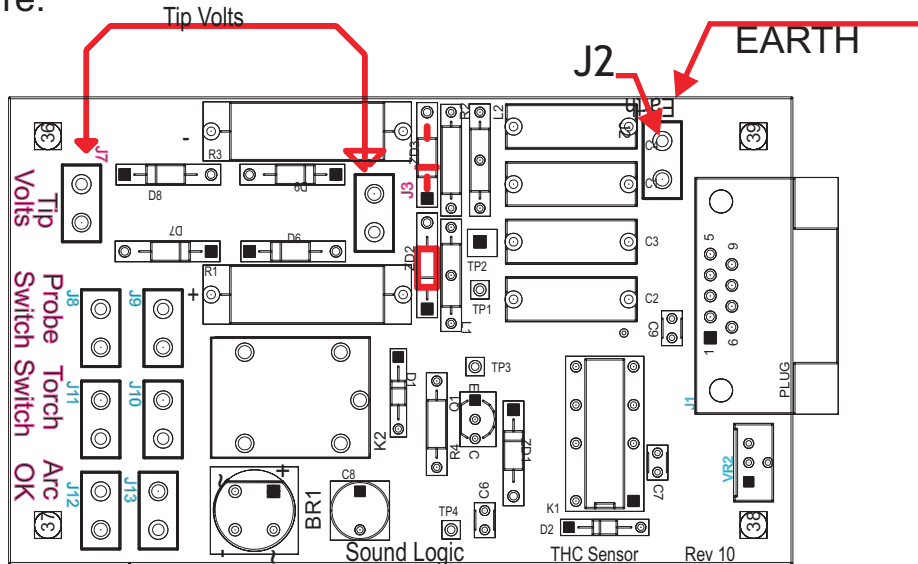
The connections to your plasma control box are made through quick disconnect connectors on the end of the PCB. J3 and J7 are the Tip voltage connections is the earth ground

J8 & J9 are the floating head switch input.

J12 & J13 the ArkOK voltage input marked ARC Good connect to your Arc Good terminal block in the plasma machine or to the terminals on the current transformer that is provided with the PC boards.

J10 & J11 the Torch Switch quick disconnects go to the switch that actually fires the plasma torch .

J2 connects to the plasma machine chassis

The **logic PC board** contains the interface to the second parallel port, the **Sensor** PCB in the plasma control enclosure and the meter panel.

The parallel port interface cable is the same as with the Sound logic breakout board. Inside your enclosure we provide a 12" ribbon cable with a 26 pin inline connector on one end and a DB25 connector on the other end. The DB25 connector can then be mounted in a small box to hold your **Logic** PC board. From the DB25 connector you will need to provide a male to male 25 pin DB 25 cable to your second parallel port on your Mach2 computer.

The **Logic** PCB contains a 10-pin connector for a 10-pin ribbon cable. The ribbon connector has a DB9 connector on one end. The DB9 connector can be mounted in you box and it will connect to a 25' DB9 cable (provided) which will then connect to the Db9 connector on the **Sensor** PCB in your plasma controller. The shell on the DB9 cable needs to be grounded to the Plasma chassis and isolated from the chassis of your cabinet at the other end of the cable to prevent ground loops.

The logic PCB also contains a 16 pin connector. A 16 pin ribbon cable is provided to connect to the meter panel.

Meter Cal
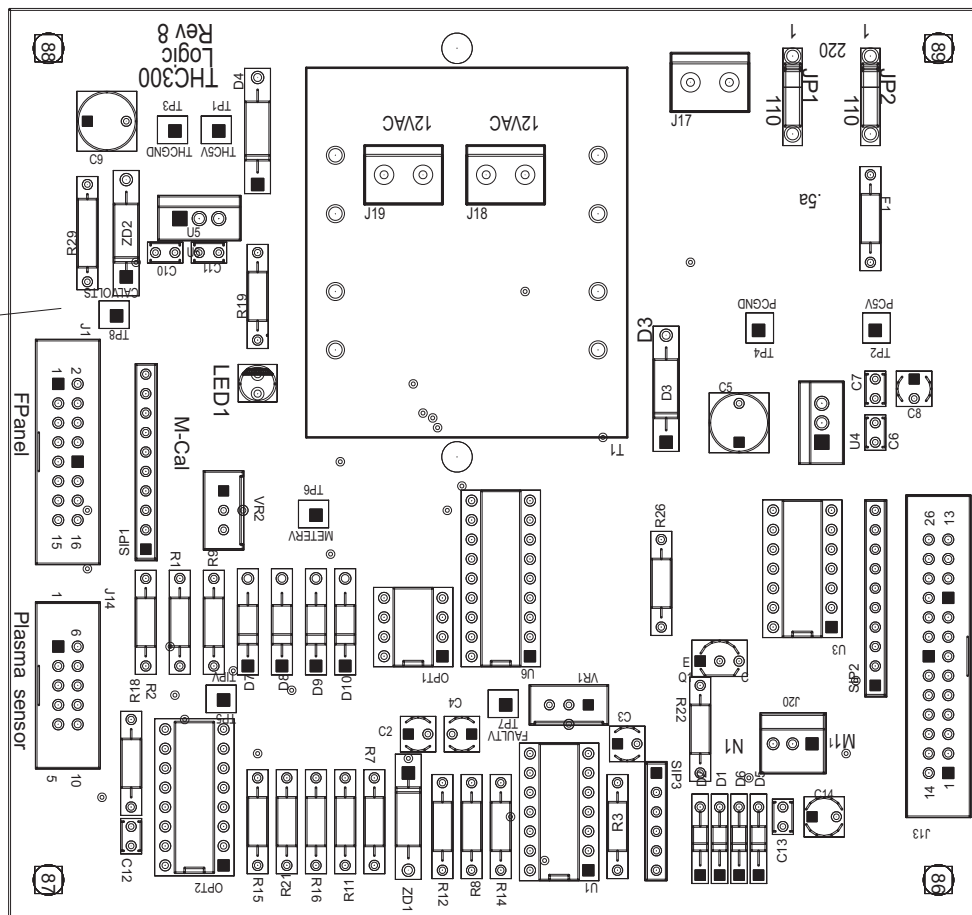
Fault Adj

Overview and Theory of Operations.

THC's has a variety of functions and features. But all use the same basic elements to control position of the torch relative to the material being cut. This "**torch to work**" distance or "**Torch Height**" is critical to both cut quality and torch tip life. If the torch is too high or too low the quality of the cut will be impaired.
NOTE: When we refer to the **THC 300 system**, we are referring to both the THC 300A board set and the code in Mach3 that controls the computer.

The power supply in the plasma machine will output from 200vdc to about 300vdc open circuit. It is a constant current supply. In other words it regulates the current to what ever you have it set for on the plasma machine. In order to do that it needs to change the voltage as the load changes. With the plasma cutting, the torch height determines the load and therefore the voltage . The current regulator lowers the voltage as the height moves lower and raises as it as the torch moves higher. The THC 300A monitors the voltage and changes the torch height to keep the voltage at a set point. It is like a servo, in that you set the reference voltage through the front panel controls and it is compared to the divided down tip voltage . If the tip voltage is higher than the set voltage then THC 300A moves the tip down, this causes the plasma current regulator to bring the voltage down. It works the same if the tip voltage is to low THC 300A moves the tip up and the plasma current regulator brings the voltage up . The THC 300A does have a window of voltage it works through. If it is less than or greater than the Fault set voltage then a Fault LED will come on and the UP and Down LEDs and commands to Mach3 will be inhibited.

If you are using sheetCAM , these setting will be added in the post for SheetCAM so you may skip to page 8.

The THC 300A set file that you will load changes the Mach3 run screen and adds three new DRO values. One is the **Pierce Gap** that is set by the operator. The other one is what we call **Switch Travel**. The THC 300A and most THC systems use a short sliding (sometimes spring loaded) attachment that the torch is attached to. The purpose of the attachment is to aid in locating the distance of the torch tip to the material at start up before the torch is fired. Installed on the slider is a limit switch. The process is to lower the torch until it touches the material and keep lowering (pushing the slider up) it until the limit switch makes contact. This distance is refereed to as the **Switch Travel**. The **Switch Travel** is set as a constant in the second DRO. The third DRO is the **Pierce Delay** value. The amount of the delay will depend on how thick the metal you are cutting is. The purpose is to allow time for the torch to pierce the metal completely before starting the cut.

Included in the install process are two macros (M3 and M5). The M3 macro is used each time you start a cut. The process here is for the torch to move to the initial pierce location, then the torch (Z axis) will move down until the probe switch on the slider makes contact. The Z axis will then move up to the pierce height, The THC 300A will fire the torch and wait for a ARC OK signal from the Sensor PCB. After the **Pierce Delay** time (this gives the torch time to burn through the material) a signal is given to Mach3 to release the X & Y axis for motion. During the cutting process, the THC 300A system will maintain the correct cutter height by monitoring the torch tip voltage and adjusting the torch height as necessary.

The M5 macro at the end of the file turns off the torch.

Finding your 2nd parallel port address

If you have already found your 2nd parallel port address, you can skip to the next page.

Your 2nd parallel port should already be installed.

To find your 2nd parallel port address in Windows XP, click on start select Control Panel. Click on system, then hardware tab, device manager. This should give you a list of all devices installed on your computer.

Click the + in front of the Ports comm& LPT entry. Then right click the second printer and select properties. Click resources. Your printer address should be displayed. Use the second number.
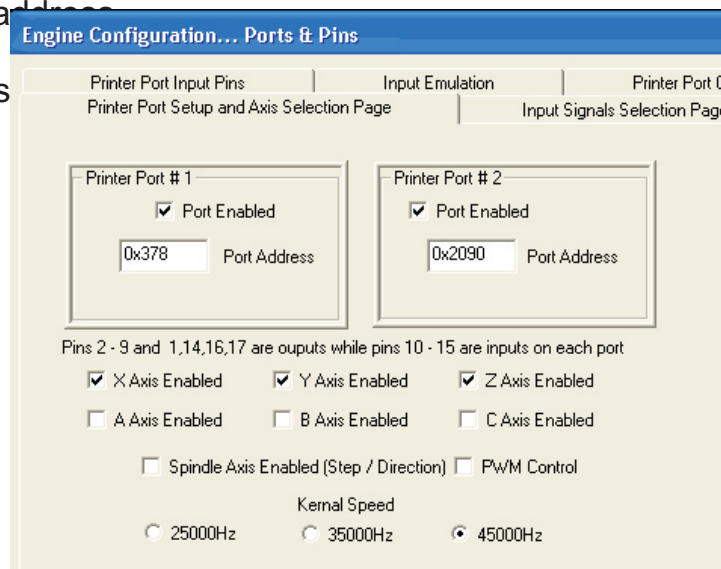Example :
 XXX 0C00
In this example the addres
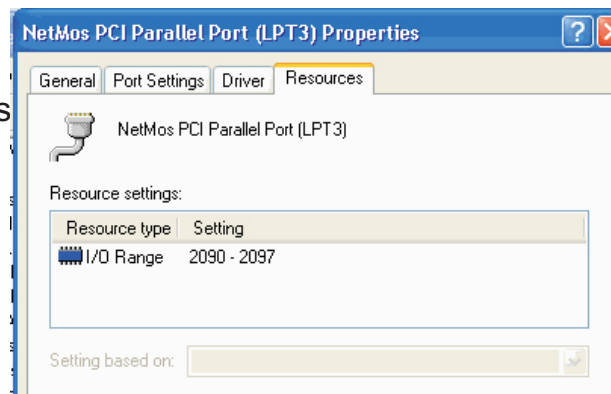
Later when you get back in Mach3 under the THC 300A profile, you will need to add the second parallel port address

NOTE: the address is 00 (from previous example).

Initial Check OUT Ver 3.0

Unpack the THC 300A and lay it out on a table close to the computer that Mach3 is installed on. Make sure that you have the address for the second parallel port handy.
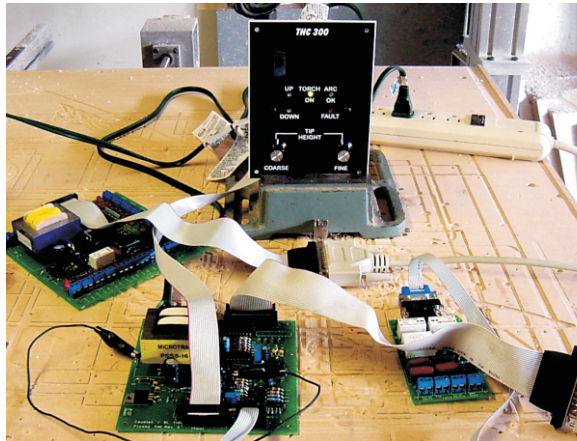
A number of screen shots of THC 300A screens and configure screens have been attached in the appendix at the end of The User Guide.

If you are not using SheetCAM .
Copy the M3 and M5 into the **Mach3\Macro\THC 300A folder.**

!With Mach3 installed

!Copy the THC300.set file and THC300.xml file into the Mach3 folder
!Shutdown your computer and turn it off.
!Connect a breakout board to parallel port #1
!Connect the J13 on the **Logic** PCB of the THC 300A to the second parallel port
!Connect the 16 pin ribbon cable into the THC 300A J1 to the front panel
!Connect the 10 pin ribbon cable into the THC 300A J14
        connect the other end to the Sensor PCB
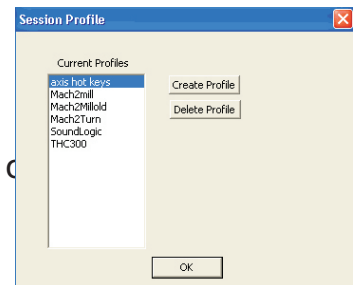!Connect the **AC** power to the **Logic** board.
!Turn the power on for the standard breakout board.
!Turn the power on for the THC **logic** board.
        The Fault LED will be on, the UP and DWN LEDs will be o
!Turn the computer on and run Mach3 (Not Mach3 mill).
    A drop down menu will appear, select **THC 300A** and
    click **OK**. When Mach3 starts click on the **RESET** button,
    It should stop blinking.

!Click on the configure ports & pins and enter the second parallel port address and
    activate by Checking the **Port Enabled**. (See example in Ports & Pins in appendix)

    Click on the Layout tab and select the THC 300A set file and press **Enter**
!   **After is is loaded** Click on the **Diagnostics** page.

! Click the **Spindle Toggle** , Torch LED will come on. The TORCH SWITCH relay will
    turn on. From the Diagnostics   page you will see the Extern 1 indicator blinking. The
    fault LED may still be on.

Center the COARSE and FINE controls on the front panel.

Locate the **CAL** test point. Clip a jumper to the **CAL** test point . (this is 12vdc).
Locate the **Tip Voltage Test Point** Clip the other end of the jumper to the **CAL**
test point . (See photo below)

 Adjust the **Coarse** control on the front panel **CW** until the **DWN** LED is **ON**.
Adjust the **Coarse** control CCW until the **UP** LED is **ON**
Select Mach3 diagnostics page
Make sure the UP & Dwn LEDs come on the same time as the UP & DWN
indicators in Mach 3
Both UP or both DWN .
Make NO adjustments on the Logic PCB.

If you have a 12 volt trasnformer you can connect it to the **Arc Good** terminals on
the **Sensor** board. You will hear the relay click and the **Arc Good** light should
come on, on the front panel. The Arc Good light on the diagnostic page should also
be on.

After confirming that everything is responding correctly and Mach3 is responding to
the in puts you are ready to install it in your system .
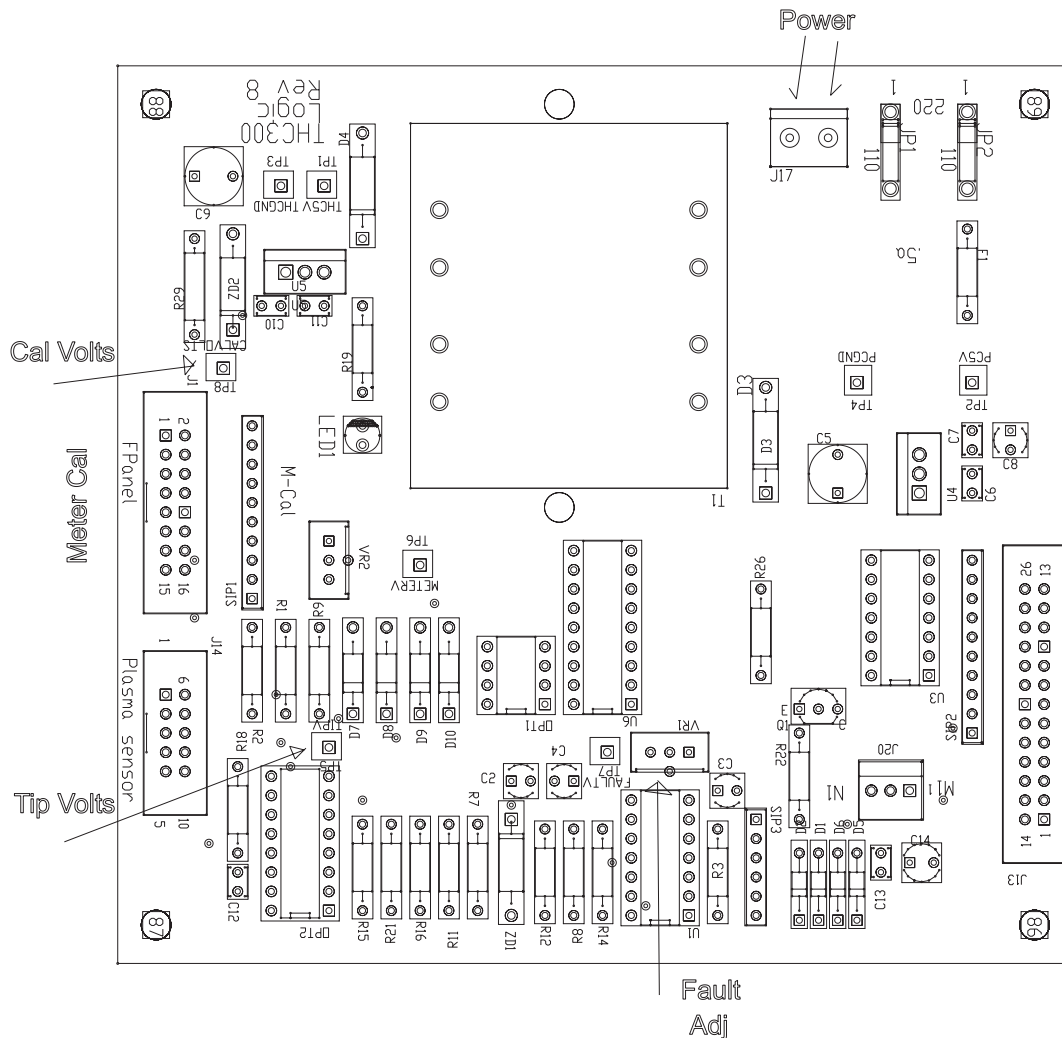
Installation and setup of your THC 300A Torch Height Control.

**CAUTION:** Portions of this install may include opening your plasma cutter machine and attaching wires. **MAKE SURE THE UNIT IS UNPLUGGED** PRIOR TO REMOVING ANY COVER(S) OR MAKING ANY CONNECTIONS. Plasma units have **HIGH VOLTAGES** present that can be dangerous or lethal. **IF YOU ARE NOT EXPERIENCED WORKING WITH HIGH VOLTAGES DO NOT ATTEMPT TO INSTALL THIS OR ANY OTHER DEVICE INSIDE YOUR PLASMA UNIT YOURSELF. SEEK PROFESSIONAL HELP.**

Sensor Board
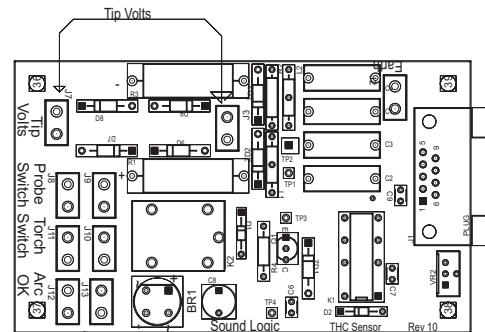
In order to control your plasma unit, there are three main connections that need to be made to the plasma unit itself. All of the following operations are to be done with the power disconnected from your plasma unit You should decide if you want to mount the THC **Sensor** PCB inside your plasma unit or in an external box on the outside of the unit. You will need access to the DB9 connector on the card so if you mount the card inside, it should be so that the DB9 is exposed on the front panel. If you cut a small square in the front panel so that the connector frame will pass through and drill two holes for the connector mounting holes you can use the connector mounting jack screws to hold the board in place. If you use an external box it is recommended that you provide external plugs for the signals listed in the following steps. External connectors, hookup wire and external enclosure are not provided.

THC SENSOR PCB INSTALL:

1.   **If your plasma unit does not have an external trigger switch**, you must find the **torch trigger switch connections.** Normally the torch handle will have at least one set of small wires coming from the torch head cable and attaching to a screw terminal post inside the box. Find the point where the torch cables enters the box and identify any small pair(s) of wires that travel up the torch head cable. On some machines there may be more than one set of small wires and are used for sensing tip shorts and other conditions. To identity the correct pair use an ohmmeter or continuity checker across each pair while you manually push the torch head button. When you identify the pair make note of where the attach. Use #22 to #18 stranded wire (twisted pair) to connect between the two screw terminals on the **THC Sensor PCB marked "Torch Switch" (J5)** to the two switch terminals in the plasma unit. There is no polarity. **NOTE**: IF your unit has noise filter chokes from the torch switch wires up to its internal logic card, it is recommend you place the two wires to the THC Sensor PCB on the other side of the chokes from their torch head connection (end closest to the internal logic card).

2.   If your plasma unit does not have a front panel voltage measurement point, you will need to locate a place inside the unit where you can get one wire onto the work clamp lead and another on the heavy lead that connects to the torch tip. You can identify both locations by visually tracing the two leads as they come into the box. You will find several locations/terminal strips that have connections to these two points and you can use those for your sense wire connections. Use unshielded stranded twisted wire of #22 to #18 ga and make a connection between the locations you have identified that tie directly to the two leads (work clamp and torch tip) to the two **"Tip"** terminals on J3&J7**.** Make sure that these wire are routed where they cannot come into contact with hot or moving components.

3. If your plasma unit does not have a front panel "arc good" signal jack do the following: Make SURE the cord to the plasma unit is disconnected from any voltage source. Check the leads with a meter…zero volts! If you have room inside the unit disconnect one of the AC hot leads prior or following the Main switch and slide the wire through the center of the current sense transformer like a finger through a donut. Re-connect the power wire. There are two connections on top of the transformer with a large power resistor across them . In addition you need to connect a twisted pair wire between the two connections and the terminal on the board marked "ARC Good"(J12&J13). No polarity. The transformer is a current transformer and forms its voltage across the power resistor. This is an AC voltage that we rectify and use to trip the Arc Good circuit /relay on the THC Sensor PCB and use the isolated relay contacts to signal the parallel port and MACH2. A good way to mount the current transformer inside the unit is to use a plastic cable tie and secure it to a nearby bundle of wires or bracket.

4. To adjust the **Sensor** PCB VR1 , current sensitivity, with the transformer connected fire the torch in the air and adjust it until the **ARCOK** LED is out on the front panel then about + 1/8th of a turn. Then start a cut and make sure that it comes on when you draw an arc in metal. It isn't a very sensitive adjustment.

Note: If you have a plasma unit that **DOES** have an Arc Good signal on the front panel you do not need to install the Current transformer and power resistor. Just make the connection to the **Arc Good** terminal. Some units provide only a **logic** level or active low signal that will not drive the Arc Good relay. Measure the Arc Good Signal. It is greater than 6 VDC and less that 40 VDC or greater than 5 VAC and less than 28 VAC then you can connect it to the **Arc Good** terminal on our board. **Otherwise,** you will need to use the current transformer.

You will need to make a connection from the THC **Sensor** PCB THC terminal **J2** marked "Earth Ground" to the chassis ground of the plasma torch.

That concludes the internal connections you will have to make for your unit. Make sure all leads are insulated and away from possible physical damage. Double check to make sure there are no loose connections and that you have attached/ re-attached any wires mentioned in the above guidelines.

**DO NOT CONNECT THE DB9 INTERCONNECT CABLE YET.**

Replace all covers and safety devices on the plasma unit and plug the plasma unit into power with the unit switched off. Turn the unit on and make sure the unit works correctly in manual mode. (i.e. cut a piece of metal by hand).

THC Logic PCB Install.

The **Logic** PCB is designed to mount inside you existing controller cabinet. It has mounting holes for using standoffs to secure the card to the bottom or side of your controller cabinet. An alternative is to install the unit in an external small enclosure. A 12" ribbon cable is provided. One end has a dual-inline (IDC) connector and the other end has a Db25 connector. The IDC connector on the ribbon cable connects to J13 and is polarized. Make sure that the red stripe (pin 1) of the cable is oriented closest towards the J13 silkscreen characters on the top of the board . There is enough ribbon cable to allow mounting the DB25 on the back panel of your controller box. Fold any excess cable and use a cable tie to form a tight bundle. You will need to provide a 25 pin Male to Male cable with Db25 connectors on both ends. This cable will connect to the second parallel port on your computer.

After you have determined the best location for the Logic Card then get the card mounted prior to making connections. The card needs switched **AC** (120VAC 60HZ).

NOTE: The board can be wired for **220VAC**
When ordering the board you can request
 that the board be wired for 220VAC. The picture
 at the right shows the board wired for 120VAC.
To wire it for 220VAC, clip the two wires at Jp1
 and Jp2. Then connect a wire at the edge of the
 Board between Jp1 and Jp2,
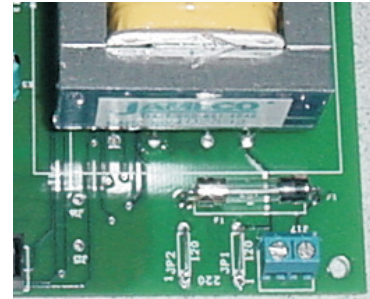
!Determine the best place to derive the voltage in you unit and with all power off make the connection Wire size can be 22 to 18ga stranded wire. There are no heat producing components on the card. So it does not need direct airflow. Do not mount it close to power switching components like PWM motor driver circuits. Do not run the ribbon cables close to power wires or within 2 inches of the motor output leads.

There are two external connectors required. The first is a DB25 which is the connection to your PC's second parallel port. With your THC board set we will furnish a 12" ribbon cable with a dual inline connector on one end and a DB25 connector on the other end.   You should have the second parallel port installed and working with MACH2. Mount the included DB25 Male jack so that it is accessible from the outside of your controller or external enclosure. To connect the jack to the PC you will need to furnish a standard DB25 Male to DB25 Male extension cable. Just make sure the cable has all 25 wires. If you are using an external box the cable shell with make the external box chassis connected to the PC chassis.

The DB9 shell needs to be insulated from your cabinet chassis. **DO NOT MOUNT WITHOUT INSULATING IT FROM THE CABINET GROUND**. It will form a **ground loop** and cause possible noise problems. Mount it where you can access it externally. Check it with an ohm meter to make sure after it is mounted. Measure between the metal of the shell and the cabinet. It should be a very high reading.

 Locate the front panel THC **Leds** PCB then find a location where you can mount the unit on your front panel or cabinet. A good option is to layout and drill a small sub-panel that you can then mount behind a square cutout. We will provide a drill pattern layout on request with the mounting holes and cutout .

FINAL SETUP AND TESTING

1. Once you have the front panel installed and the DB25 and DB9 connectors mounted apply power (AC) to the **Logic** PCB and with the DB9 still disconnected you should see the Fault light on and no voltage on the meter. All other LEDS should be off. Turn off the power to the controller and the plasma unit. Connect the shielded DB9 cable from the plasma THC **Sensor** PCB to the **Logic** PCB.

2. Make sure your computer parallel port 2 is connected to the DB25 on the **Logic** PCB and boot up your computer and load MACH3.
 NOTE: At this point you should refer to the MACH3 manual on setup of MACH3 for THC operation. The UP and DOWN inputs are active low (box checked). There is a button to enable the THC in MACH3. Make sure you have the pins listed in the addendum mapped to the correct pins on the second parallel port (port 2) in MACH3

3. With the torch head .5 to 1 inch above the material manually active the torch by using the button/hotkey associated with extactivate1 (normally the spindle ON or an M03 command in the MDI). IF the torch lights then go to 4. If it does not double check all of your **logic** and pin setup in MACH3. Go to the diagnostics page and make sure the extactivate1 LED is flashing.

4. Once you have ignition you are close to liftoff! Load a test program for the plasma. We have included a program that cuts a series of simple geometric shapes on a two foot square piece of material. The feed rate is set for 1/8" material and is 55IPM ; it may need to be changed for thinner material or other materials besides steel. For 16ga steel change the F55 commands to F100.

5. Make sure the THC is turned on in MACH3 and you have the pos and neg limits set to logical numbers. Start out with min=+.080 and max=+.350. **TURN OFF THE PLASMA TORCH** but leave all cables connected. Start your cut. The table should move, the Torch ON led should light and the table movement should **stop**. It should be waiting for the arc good signal from the plasma. If it does not stop check the polarity of the input for TORCH HEIGHT ON in MACH3. Check the screen LED associated with that input. It should be OFF (inactive). Once you have the arc good portion working proceed to 6

6. With the plasma unit powered up. Rewind the test program and with the THC enabled, start the cut. The Up and Down LED's in MACH3 should have distinct transitions and the front panel LEDs should track the screen LED's. The movement LED on the front panel should be on. Note the indicated tip voltage and the height in the Z DRO. Make sure that the THC DRO showing the amount of adjustment is changing. If UP or DOWN stays on you have reached the limit of the values you have set in the Max and Min (or the head is not adjusting correctly). The best setting is where the head is tracking about .125 above the material and the UP and DOWN LED's are mostly both off. If you have a digital meter adjust the cut so the indicated voltage is 139VDC and use the fine adjust to trim to a best height.

7. **Enjoy your new THC**!

Floating Head switch used with the Probe function

 Connect the floating head switch across the Z axes Limit input . On the Sound **Logic** breakout board it is assigned to pin 13 of the first parallel port. You have the option to connect the float head switch to the sensor board. If you do, then map it in mach3 to port2 pin 13 Active LOW
The pin are set up in the THC300.xml. All pins are set to **Active LOW**
If you use a different breakout board you will need to consult the set up documents for that board. As long as you use the pin assigned to the Z limit and assign that pin to the probe function it should work for you.

Most plasma's will have 200VDC to 300VDC on the tip open circuit (torch fired, no arc). A good place to start for average cutting of steel approx 1/8" thick is around 139V so using that as a starting reference it you should be able to watch the meter and the height in MACH3 on the Z and adjust the pots until you get the average cutting height you want and make a note of the meter position. Since it is linear the "sweet spot" will be either slightly above or below the position you note on most cuts. There is not but a few volts variance as the height changes so using the digital meter makes things more precise and controllable.

 To find the **Switch Travel** on you machine, place a flat piece of metal under the z axes on the table, Jog the Z axis down until the tip just touches continue until the switch closes (monitor on the diagnoses page). Zero the z-axes **DRO** then jog the z axes UP slowly until the switch just opens. The reading in the **DRO** is the **Switch Travel** It should be entered as a positive number.

THC 300A Ver 3
Port 2 pin out.

Pin **J13-**1   Torch On
        Turns the relay on that is across the trigger switch on the torch head

Pin **J13-**11   Down
        Move the Z axes down

J13-12   Up
        Moves the Z axes UP

J13-13   Input for the Floating head switch

J13-15   Arc OK
        Lets Mach2 know when it detects a Good Arc

J13- 2 to 9 not used

J14 is the DB9 connector to the sensor PCB

J14-1 Isolated Gnd
J14-2 Floating head switch
J14-3 Arc OK Signal
J14-4 Arc OK LED-
J14-5 Open
J14-6 Isolated +12v
J14-7 Torch ON
J14-8 Tip voltage -
J14-9 Tip voltage +

J1 Front Panel 16 pin IDC connector

J1-1 Down LED +
J1-2 Down LED
J1-3 UP LED +
J1-4 UP LED
J1-5 Fault LED +
J1-6 Fault LED
J1-7 Torch On LED +
J1-8 Torch On LED
J1-9 Arc OK LED +
J1-10 Arc OK LED
J1-11 Tip Voltage Adjust Pot
J1-12 Isolated gnd
J1-13 Meter +
J1-14 Isolated Gnd
J1-15 Isolated +5v for Digital meter
J1-16 Fine Cut

TP1 Isolated +5v
TP2 PC+5v
TP3 Isolated Gnd
TP4 PC Gnd

VR1 Fault Adjust:
        The Fault LED will come on if the Tip Voltage is greater than 200 or lower than30vdc.
         this is a factory adjustment.
Note: When the Fault LED is on it inhibits the UP and Down.

VR2 Meter calibration:
     This is a Factory adjustment and should not be adjusted in the field.

Sensor PCB :

J1-1 Isolated GND (THCgnd)
J1-2 Floating Head switch in
J1-3 Arc OK signal (from K1)
J1-4 Arc OK LED (from K1)
J1-5 open
J1-6 Isolated +5v (THC +12)
J1-7 Torch ON Relay K2 coil-
J1-8 Tip Voltage 1
J1-9 Tip Voltage 2

Tp1 &TP2 Tip Voltage divider out
TP3 ARC OK voltage to K1 coil
TP4 ARC OK gnd to KE coil

J2   Torch Earth   Earth gnd to be attached to Plasma chassis gnd.

J3   Tip V   Tip Voltage from inside plasma machine
J7   Tip V   Tip voltage Return inside plasma machine

J10   Torch Switch   Attaches across the trigger switch
J11   Torch Switch   inside the plasma machine

J12   Arc Good   From the current transformer or
J13   Arc Good   the Arc Good signal from the plasma machine

Vr1 Arc OK sensitivity.
**   The pot is set in the center when shipped.**
**   1. If you have a GOOD ARC signal from your plasma machine make sure the pot VR1 is centered.**
**   2. IF you are using the provided current transformer :**
!   Manually trigger the plasma in the air and adjust VR1 until the ARC OK LED just   turns off.
**   2. Start a cut the current will go up and the ARC OK LED will come on.**
**   The idea is to insure it does not come on until you are actually piercing the metal.**

James_cullins@sbcglobal.net
 bob@campbelldesigns.com

THC 300A Set File

This screen is used when you are NOT using Sheetcam.

The THC 300. set file has three extra DROs added to enter setup values for you machine.

!Pierce Gap: sets air gap between the material and the torch tip to start piercing material.

!Lost Motion Z : Lost motion in the floating head between where the head touches the metal and where the touch-off switch trips.

!Pierce Delay Sec.: The delay after Good Arc signal is received. This allows the torch to fully penetrate the material before motion is started.

In order to use the "THC300.set" and the M3 macro provided you will need a floating head setup on the Z axes. I used a 6" section of THK rail mounted to the Z axes and a bearing mounted to the back of the torch mounting plate. You may need some springs to make it operate properly. Mount a micro switch or a proximity switch so it will trip when the Z axes moves down and strikes the material surface. There is some dead space or lost motion between when the head touches the surface and when the switch trips. This distance is entered in the Lost Motion DRO from the THC 300A run screen. See the GIF file.

This is the M3 macro and how it works.

```
M3:
code "g31z-1"              ' moves until touch-off switch closes or to 1 below zero
While IsMoving()           ' this makes it wait till all movement of the probing is done...
wendif
( IsFirst() )   then
  adder = GetUserDRO(1000)        ' adder will be the DRO reading only on the first m3 in the file...
  lossz =   GetUserDRO(1002)       ' lossz will be the DRO reading loss motion in the floating head
else
  adder = 0
  lossz = 0
endif
code "G92Z0"
 code "G1Z"  &  lossz + adder
 While IsMoving()   ' this makes it wait for the above to complete...
wend DoSpinCW()
code "G4 P" & (getUserDRO (1001))
```

The idea is to start the PROBE command G31 Z-1. The Z axes will move down until the touch-off switch closes or to 1 inch which ever is first. You can change the M3 macro, first line, to G31 Z-3 or what value your machine requires.

Once the X,Y axes moves to the point to start a cut the following sequence of events happens.

!G31 Z1 sends the Z axes down until the Touch-off switch closes.

!Z reverses up to the Touch off switch opens.

!Reads the user input torch height and the dead space for the touch-off switch.

!G92Z0 zeros the Z axes

!G1Z & lossz + adder moves the z to the proper height to start the pierce.

!Waits for an ARC GOOD signal from the THC 300A hardware.

!G4 sets the delay to allow the torch to cut all the way through the material (user input).

!Start motion

If you have a favorite SET file that you prefer, all you need to do to use the M3 macro is copy the 1000,1001 and 1002 DROs from the THC300.set file and paste them into your set file via screen designer and copy the M3 macro into the macro sub.

Make sure to make a back up copy of both the standard M3 and the M3 used with the THC.

I hope this will help all those who are, or are planning to use a plasma cutter.

This method is used with SheetCAM

This method was provided by Tom Caudle.
His post processor is modified to include the G28.1 Z .5 code.
Here is the way he uses it.
G28.1 Z .5 says to rapid down until you hit .5 then use the Reference speed to move
to the Touch Off switch mounted on the floating head. Once activated it zero's the
DRO and rapids
back to .5 (with .5 showing on the DRO). If you have some method of making
sure the Home is at true material zero then from that point MACH2 always
knows where it is. The pierce height is a constant that I have plugged into
my post processor as well as the beginning cutting height. The head moves
to the XY pierce position, moves to the Z pierce height (.185 above the
surface) and fires the torch. When the Arc Good releases the code the very
next thing in the program is a Z move down to .125 followed by XY movement
so we first pierce then with the flame cutting move the tip closer and start
cutting. The reason for piercing high is the fact that as the arc
penetrates the metal the molten steel has no place to go but back towards
the surface. Sort of like turning a hose on a bowl. That condition only
lasts until the flame breaks through then all of the molten stuff goes down.
If you pierce too close the blow-back tends to clog the tip and cause
premature failures. If you pierce too far away the flame is less
concentrated and either takes too long to pierce, or burns too big a hole in
doing so.

James_cullins@sbcglobal.net
Sound Logic